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Award Number: W81XWH-12-2-0026

TITLE: A Theoretically Driven Investigation of the Efficacy of an Immersive Interactive Avatar Rich Virtual Environment in Pre-deployment Nursing Knowledge and Teamwork Skills Training

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ABSTRACT

The Department of Defense has only one Level I trauma center making the education, training, and sustainment of deployment critical trauma management skills of military nurses far more challenging. Military nurses recognize the need for pre-deployment and sustainment training that enables high functioning clinical and teamwork skills. However, the existing programs for such pre-deployment training fail to reach all deploying military nurses or are given "just in time" when learner readiness may be adversely affected by the stressors associated with preparing to depart home station for deployment. Current military medical training reflects variability across the services and between military training centers in relation to the curriculum presented, instructional pedagogy, and instructional quality. Measures of effectiveness data is minimal and often has not been conducted in a rigorous manner. To be clear, tremendous capability and dedication exist within the Nurse Corps', but training program improvements can and should continuously be tested and made available. It is to this need that Virginia Modeling, Analysis and Simulation Center in Norfolk Virginia (VMASC) was funded by U.S. Army Medical Research and Materiel Command (USAMRMC) via Telemedicine and Advanced Technology Research Center (TATRC) to engage in a 2 year study to develop a pre-deployment process that focuses on building trauma management skills on a solid medical-surgical foundation.

The overall purpose of this study is to design and develop in year one, and then ultimately investigate in year two, the use of an interactive virtual training environment designed to be consistent theoretically, conceptually, and functionally, with evidence-based military trauma nursing practice. Learners will ultimately be tested to establish if real world experiences can be sufficiently mimicked or simulated, thereby reflecting a "maturity" in the learner's performance both on the computer and in the simulation center. It is postulated that the improved performance will transfer to the operational setting and reflect improved outcomes in the care rendered.

Table of Contents

1. INTRODUCTION:

In March 2008, The Council on Physician and Nurse Supply determined that 30,000 additional nurses should be graduated annually to meet the nation's healthcare needs, an expansion of 30% over the current number of annual nurse graduates. Nursing is facing the imminent loss of large numbers of highly experienced clinicians due to retirement. The Bernard Hodes Group, reported in 2006 that 55% of surveyed nurses intended to retire between 2011 and 2020. As we lose highly experienced nurses and replace them with new clinicians, it is clear that the education process must be both compressed and optimized to meet professional standards and counteract the further inventory decline of staff and faculty nurses. No longer can we count on expertise to develop over time. The need for education and training innovation is paramount in order to help close the escalating numerical and experiential gap.

In the military healthcare system there is a need to accelerate the learning timeline to enable nurses who are junior or taking on new clinical roles to meet patient and mission needs. Some nurses must deploy as individual augmentees. This situation does not accord the usual familiarity and security of training and deploying with a cohesive and familiar team. We know patient safety and clinical care are impacted by the functionality of the team. The constant insertion of new and uninitiated staff can have a de-stabilizing effect.

This proposal focuses on a common educational thread recognized by all military nurses, the need for pre-deployment and sustainment training that enables high functioning clinical and teamwork skills. There are no Level I trauma centers in the Navy or the Air Force. The trauma and deployment skills are acquired through individual programs and experiences. There are significant efforts being made to enhance military nurses' deployment competencies. These efforts primarily include 2-3 day didactic courses including field and/or simulation center based demonstrations and return demonstrations. Many instructors have developed great expertise and unique knowledge from their operational deployment experiences. Some instructors come into the services with extensive trauma backgrounds, but these are a minority. In certain cases, the current training process has significant variability in curriculum presented within an institution and across the Department of Defense. This variation impacts the instructional pedagogy and instructional quality between the programs offered. Efficacy studies beyond student satisfaction scores have not been done in a rigorous manner. For example, many Navy Nurse Corps officers, but not all, attend a 21 day trauma care introduction course at the Navy Trauma Training Center. This program is conducted at Los Angeles County, University of Southern California Medical Center, an ideal location for this training as the center averages over 25,000 trauma evaluations and 6,000 trauma admissions annually. This program is not unlike the "just in time" training afforded the Army and Air Force Nurse Corps officers, also conducted at nationally known and respected Level 1 civilian trauma centers. But existing programs fail to reach all deploying military nurses or when given "just in time" the learner's educational readiness may be adversely affected by the stressors associated with deployment. To be clear, tremendous capability and dedication exist within the Corps', but improvements can and should be made available.

The purpose of this study is to develop a curriculum tailored to complement an educational approach using an avatar-rich and highly interactive virtual game based environment. This computer based pre-deployment nurse training module is designed to mimic specific real world experiences using an evidenced-based nursing care curriculum as the foundation. Core clinical capabilities include a strong emphasis on assessment, priority setting, and TeamSTEPPS. For this program, clinical competencies were identified from the information and data from military nurses, feedback and data extracted from the Navy/Marine Corps Combat Trauma Registry, the Joint Theater Trauma Registry, Army, Navy, and Air Force Nurse Corps Subject Matter Experts (SMEs), the Tri-Service Nursing Research Program's Battlefield and Disaster Nursing Pocket Guide, as well as excerpts from the operationally relevant Borden Institute texts. Evidence based practice interventions are based on the Clinical Practice Guidelines from the U. S. Army Institute of Surgical Research (USAISR).

In order to capture the needs of the deploying military nurse, it is vital to include military nurse SMEs in the design and content of the software. Military nursing expertise is being used along with the above noted resources, to identify medical-surgical skills that form the basis of the curriculum and program development for initial pre-deployment trauma nursing care. A major part of our project requires collaborating with military SMEs to gather the information needed to create the product. The military SMEs provide input so the scenarios can mirror "real life" occurrences. We are trying to model practice to generate and simulate "experience." When we gather the necessary information regarding the content of the modules, VMASC utilizes the expertise of Breakaway Ltd. for the programming and development of the virtual learning environment.

It is to this effort that Virginia Modeling, Analysis and Simulation Center (VMASC) in Norfolk Virginia was funded by Tri-Service funds via TATRC to engage in a 2 year study to develop a pre-deployment process that focuses on building trauma management skills on a solid medical-surgical foundation. Due to the complexity of the task, the research process has been divided into 2 phases, an educational software design and development phase in year one, and the research phase in year two.

TATRC Award began on May 1, 2012, followed by the Official Kick Off Meeting with Dr. Kevin Kunkler, Mr. Harvey McGee, and entire research team on June 5, 2012. This Annual Report covers the time period from May 1, 2012 through April 30, 2013.

2. KEYWORDS:

Military nursing
Pre-deployment training
Avatar based training
TeamSTEPPS training
Critical care
Trauma management
Simulation
Game-based technology

3. OVERALL PROJECT SUMMARY

3.1 IRB APPROVAL STATUS YEAR ONE, SOFTWARE DEVELOPMENT PHASE

This project is divided into two distinct phases of work. The first phase reflects the process of iterative process improvements to develop a scientifically grounded pre-deployment educational program to be used in the design and development of an avatar rich virtual clinical environment for nursing trauma management and care. Year two will test the efficacy of the simulation based computer generated training program. To meet the requirements of the two distinct phases, we are submitting two sets of IRB proposals, each tailored to reflect the work of either year one (Development Phase) or year two (Research Phase). Please find a summary of the project timeline in Appendix A.

IRB approval has been obtained for year one, which involves development of the computer training software. Approval dates for Old Dominion University Research Foundation (ODURF), Naval Medical Center Portsmouth (NMCP) and Naval Medical Center San Diego (NMCSD) are April 26, 2012, April 4, 2013, and February 5, 2013 respectively. Reference the summary of IRB submissions, delays, and approvals below.

3.1.1 IRB Approval Status Year One, Software Development Phase

CRADA with NMCP, NMCSD, and ODURF

- Although VMASC began the CRADA request process before Award notification (March 14, 2012), due to the Navy's multi-layered CRADA review process, the CRADA between NMCP, NMCSD, and ODURF was not approved until August 22, 2012.

CRADA with US Army Institute of Surgical Research (USAISR)

- This study's cooperative agreement for collaboration with the Army and Joint Command nursing and medical staff commenced after study kick off. An additional CRADA was obtained with the USAISR; we anticipated the need to share non-patient linked photos of wounds.
- CRADA between the research team at VMASC and the USAISR at Fort Sam Houston, Texas was finalized on March 20, 2013.

ODU Approval

- IRB approval obtained from Old Dominion University on April 26, 2012.

NMCSD IRB Approval Final on April 9, 2013

- After a delay in scientific review by NMCSD Nursing Research Department, NMCSD submission was completed on November 5, 2012.
- Per the Clinical Investigation Department (CID) at NMCSD, the office was short staffed and would not be able to review the protocol submission until "after the first of the year" (November 27, 2012).

- On February 6, 2013, IRB Chair recommended approval pending minor modifications and clarifications.
- Modifications and clarifications were completed on February 20, 2013. Per CID, the document was forwarded by the IRB to the NMCSD Commander for approval (April 9, 2013).
- On April 14, 2013, documentation of NMCSD IRB Approval was received.

NMCP IRB Approval Final on April 4, 2013

- NMCP PI on board during kick-off had a change of orders during the summer of 2012. Once the replacement came on board, the IRB documents were updated. They were submitted to the NMCP IRB on September 24, 2012. This detachment period resulted in a 2 month vacancy of the PI position at NMCP.
- Unanticipated delays in moving the proposal out of administration to review of proposal occurred due to a requirement to re-submit multiple times for updates in submission forms. With each new update, we were required to re-submit the proposal of this expedited process improvement phase project. An additional delay was incurred by the NMCP IRB in December 2012 due to a new requirement for the proposal to be reviewed by Internal Medicine Department for scientific validity and appropriateness of experimental design; this scientific review was completed on December 14, 2012.
- NMCP IRB requested revisions to the submission on January 18, 2013; revisions were completed.
- NMCP IRB approved the submission on April 4, 2013.

US Army Institute of Surgical Research (USAISR) Research Regulatory Compliance Division (RRCD)

- On May 6, 2013, USAISR RRCD determined the software development phase of the project does not involve human subject's research. Therefore further IRB review is not required for the development of the software.

3.1.2 IRB Approval Status Year Two, Research Phase

- Submission of the Protocol for the year two, Research Phase, is planned for summer of 2013.
- During the Research Phase, we will test the efficacy of the virtual training environment, course content, and translation to practice as demonstrated in the learner's performance and execution of similar clinical scenarios in the simulation center.
- IRB submission will be made to the ODURF, NMCP, NMCSD and USAISR IRBs.

3.2 LEVERAGING SMEs FOR CURRICULUM DEVELOPMENT

Army

We have forged very strong and fruitful collaborations with our Army partners and members of Joint Services Command. Nursing and medical leadership of the following Commands provided significant support, interest, and work on trauma scenarios with grading tools. Lieutenant Colonel Mark MacDougall, Deputy

Commander, Defense Medical Readiness Training Institute (DMRTI), Fort Sam Houston, Texas was our primary Point of Contact. Initially, with LTC MacDougall's help, significant training collaborations were forged. Dr. Andrea Parodi, the Principal Investigator, was able to make two site visits in the last 6 months. We acquired agreements for collaboration and information sharing with: DMRTI, and USAISR in order to incorporate their work on physiologic models, human factors, trauma, and burn care into our project. The team spent considerable time in the USAISR Burn Unit and Simulation Center as well. Discussions were held and agreements reached with the Comprehensive Intensive Care Research Group, the officers and senior enlisted members of the DMRTI field operations team for the Combat Casualty Care Course (C4) at Camp Bullis, Texas, as well as the leadership of Emergency War Surgery Course. The work conducted here was a major breakthrough for this project and set the stage for a comprehensive scenario and tool development cycle. The interest and recognition of need continues to grow.

Several other collaborative partners are now on our team. First, Lieutenant Colonel Elizabeth Mann, Senior Nurse Scientist Institute for USAISR, who is well known for her work in burn care, leads scenario development for the section of the program dedicated to care of the major burn patient. Next, Lieutenant Commander Ken Kingdon MC, USN, representing the Emergency War Surgery Course (DMRTI) offered support for content reflecting physician scope of practice questions. Also, Captain Jamie Garrick, Army Nurse Corps and Captain Frederick Santillan, Air Force Nurse Corps from the San Antonio Military Medical Center (SAMMC) (formerly Brooke Army Medical Center) are coordinating the head trauma module as well as the scenario dedicated to patient preparation for en route care. Both of these officers recently returned from Afghanistan and are now assigned to the Trauma Team at SAMMC.

The Principal Investigator (PI) has been in discussions with Dr. Carl Schulman MD, Director for the Ryder Trauma Center, University of Miami, Florida. The Army conducts their Forward Surgical Team (FST) training at Ryder Trauma Center. They too are a TATRC award recipient, and we were able to agree on a course of mutual support. Thanks to Ryder Trauma Center support, we are able to use and integrate the Army Trauma Training Center's video training materials on trauma care into our virtual Camp Resilience.

Navy

Lieutenant Commander Nathan Brezovic is our NMCP site PI. As a Master's prepared critical care nurse practitioner, he brings a wealth of operational and clinical experience to the team. He has deployed in support of several operational deployments and served in Afghanistan, Iraq, and aboard the USNS Comfort.

Mr. Don S. Raymundo, RN, BSN, MA, our NMCSD PI, is a retired Commander in the Navy Nurse Corps. He currently serves as Clinical Educator in the Medical Surgical Simulation Center at NMCSD. Our formal relationship with Navy is in its

early stage. The teams are eager to support our further development.

3.3 CURRICULUM DEVELOPMENT

3.3.1 Team STEPPS

Team STEPPS is an evidence-based teamwork system to improve communication and teamwork skills among healthcare professionals. This system was developed by the Department of Defense's (DOD) Patient Safety Program in collaboration with the Agency for Healthcare Research and Quality (AHRQ). An entire module is dedicated to TeamSTEPPS. In our curriculum, we address the four principle TeamSTEPPS skills; leadership, situation monitoring, mutual support, and communication. These skills are presented in an instructional presentation by the virtual nurse preceptor in the virtual trauma care area. Once the concepts are presented, learners are transitioned into guided practice mini-games designed to enable them to apply what they have learned in order to crystallize their knowledge (see Software Development Section for details).

There are also TeamSTEPPS video vignettes to illustrate key points like the brief, huddle, and debrief as well as the "SBAR" (Situation, Background, Assessment and Recommendations). The TeamSTEPPS module also contains a copy of the TeamSTEPPS Pocket Guide that corresponds to the DOD course.

3.3.2 Trauma Curriculum

The extremities are still the most commonly injured anatomic region, accounting for over half of all combat injuries. Other anatomic sites commonly injured are the head and neck, face, thorax, and abdomen (Owens, Kragh Jr. et al. 2008). Therefore, we have developed an instructionally sound structured curriculum based on a set of scenarios and theme-driven modules that reflect patient care of some of the most prevalent wounding patterns. Training scenarios incorporate the most current USAISR Clinical Practice Guidelines. Procedures are cross referenced with the Tri-Service Nursing Research Program's Battlefield and Disaster Nursing Pocket Guide, the American Association of Critical Care Nurses Procedural Manual, and Borden Institute texts.

The "Introduction to Trauma" module includes team structure (surgeon, anesthesiologist, respiratory therapist, nurse, medic etc.), information on the roles of team members and tasks by role, and primary and secondary trauma assessment. In addition, infection control measures and personal protective equipment are addressed.

Scenario content emphasizes the importance of primary assessment, as the management of severe multiple injury requires clear recognition of management priorities and the determination of those injuries that threaten the patient's life. The primary survey addresses the "ABCDE" of trauma (airway, breathing,

circulation, disability, and exposure). Our focus is to have the learner recognize, diagnose and treat life threatening injuries which if left undiagnosed and untreated, could lead to death. Once the primary survey is complete, a head-to-toe examination (secondary survey) will take place to include head, neck, neurological, chest, abdomen, pelvis, and limb examination and assessment.

The final trauma module titled "Putting it all Together" is now under development. This module involves the care for a patient with facial trauma, ocular injury and burns to chest, arms, and upper thighs, as well as the challenges of blast injury and pain management for the poly-trauma patient. Care will evolve from the initial MIST Report (M-mechanism of injury; I-injury; S-status of vital signs and GCS; T-treatment already rendered in field) through primary and secondary survey to the stabilizing management of an unstable patient with handoff to the operating room, or preparing the patient for transport to the next level of care.

3.3.3 Pre-test and Post-test Final module

- In order to show statistically significant increases in learner core content knowledge following the completion of the Nursing Avatar Training Program, a pre- and post- test was created.
- In addition to post-test, learner satisfaction and self-confidence will be measured using "Satisfaction and Self Confidence in Learning" survey provided by the National League of Nursing (NLN). Permission to use this validated survey was granted by NLN on January 8, 2013.

3.4 SOFTWARE DEVELOPMENT

- Module 1, Prelude: This module includes the General Introduction to the training program and process as well as test items for the knowledge pre-test.
- Module 2, Navigation Tutorial: The Tutorial includes an introductory scenario to familiarize the learner with the computer system's navigation controls, interactive elements, and communication options. Further updates will be made towards the end of the software development process, as different navigation capabilities will need to be created as the scenarios develop.
- Module 3, TeamSTEPPS (AHRQ): This module educates learners about teamwork and communication principles for patient safety by providing interactive game-based learning experiences in the content.
    - Each TeamSTEPPS instructional presentation depicts the clinical team (including the learner) having discussions with a virtual nurse preceptor in a virtual trauma unit. The educational material is presented in both text and graphical formats. Once the concepts are presented, learners are transitioned into guided practice mini-games designed to crystallize knowledge.
    - Mini-games are incorporated in a timed, competitive environment where both speed and accuracy are reinforced. Each mini-game is set up with a different set of rules and objectives in order to keep

the practice interesting and engaging for learners.
    - Please refer to Appendix B for screen shots of the training software.

- Trauma Scenarios

Module 4, Introduction to Trauma, we will present a scenario involving a virtual patient with a high lower extremity amputation and large abdominal wound with evisceration of abdominal intestines from an improvised explosive device. There will be shrapnel and dirt present in the leg wound as well as peppering the patient's body. *Status: Scripted but still in computer development.*

Module 5, Putting It All Together, involves the care for a patient with facial trauma, ocular injury, and burns to chest, arms, and upper thighs as well as managing the challenges of pain management for the poly-trauma patient. Care will involve assessment of facial and scalp lacerations and management of a patient with a declining level of consciousness. This patient will also present with a lower extremity amputation. *Status: in development.*

Our trauma scenarios will unfold in the virtual trauma unit. This virtual trauma unit was designed to replicate the layout and location of equipment, supplies and other resources in a real field setting. An additional room, the conference room, was created for debriefing and other educational activities. This virtual trauma unit allows the learner to communicate and interact with the virtual patient and medical staff located around the bed. Additionally, this helps the learner understand some of the pressure they will be under while providing nursing care in such an environment during deployment.

The learner will be represented in the virtual environment as a nurse avatar who performs diagnostic and therapeutic actions on the virtual patient. Other team members like the surgeon, medic, medication nurse, scribe nurse etc. will perform tasks appropriate to their role as well. A nurse preceptor will be present to guide the learner through the scenario and provide important instruction.

The virtual patient will exhibit physiological responses to the clinical interventions. The four physiological parameters including heart rate, blood pressure, respiratory rate, and oxygen saturation will be programmed into the system, so virtual patients will respond appropriately to the team member's clinical interventions. If clinical priorities are not correct or attention is focused on a secondary problem, vital signs will deteriorate, and the virtual patient will die. The learner will be tasked to make critical decisions which will be graded and timed.

- Motion Capture methodologies have been developed for the avatars. This allows incorporation of motion captured animation into the application pipeline.

- Virtual Resource Repository
  Contents for a Virtual Resource Repository have been added to the game-based training program for quick and easy reference when needed by the learner.

  The Borden Institute has given us permission to place three of their complete textbooks within our virtual resource repository to include "Emergency War Surgery", "War Surgery in Afghanistan and Iraq", and "Combat Casualty Care, Lessons Learned from OEF and OIF". The Ryder Trauma Center has shared video training clips for 32 topics. These clips will be used either as part of a particular scenario or will be accessible to learners in the Virtual Resource Repository. In addition, user manuals and videos of medical equipment commonly used for trauma care have been added to the resource section of the training program for reference in the event the learner requires additional information. Equipment addressed includes:

  - Bair hugger
  - CAT manual tourniquet
  - Combat Ready Clamp
  - Thoracic Drainage Aspirator
  - Univent 750 Ventilator
  - Level 1 Transfuser
  - Pleur-evac A-7000 Chest Drainage System
  - Pleur-evac Sahara Chest Drainage System
  - Propaq Encore Monitor
  - Thermal Angel Blood and IV Warmer
  - Zoll Life Pac 20
  - Intraosseous Infusion System (EZ IO)

- Challenges to Software Creation
  During the early stages of software development, BreakAway Ltd. made modifications to Unity 3D-based vHealthCare 3.0 platform to accommodate the expected content of the Avatar Pre-deployment Nurse Training Program as well as to expand web-based capabilities. Transitioning vHealthCare to Unity has delayed progress as it has required significant time to reprogram all prior assets to Unity and correct for new system instabilities. Currently, most trauma treatment assets (skills and equipment) have been converted to Unity for the Introduction to Trauma Module (Module 4). VMASC is supporting BreakAway Ltd. with motion capture and voice over production. This is an excellent team that is working to meet team goals in a mutually supportive and highly congenial

collaboration.

- Eyetracking
  Team members Andrea Parodi, RN, DSN; Bridget Giles, PhD.; and T. Robert Turner completed several eye tracking training seminars conducted by Kara Latorella of KAL Enterprise LLC. Training included a review of oculometry basics and oculometry operating system. Team members completed hands on exercises for camera calibration, profile generation, gaze calibration, and quality assessment. Breakaway Ltd. and KAL Enterprise LLC are currently working to add programming requirements necessary to support eye tracking data collection with the Avatar Pre-deployment Nurse Training Software for process improvement.

4. KEY RESEARCH ACCOMPLISHMENTS:

- IRB approval has been obtained for year one, which involves development of the computer training software. Approval dates for ODURF, NMCSD, and NMCP are April 26, 2012, February 5, 2013, and April 4, 2013 respectively.
- Key collaborations have been made with Army, Navy and Air Force SMEs who have been vital in providing recommendations, expertise, and the generation and review of scenario content.

5. CONCLUSION:

The care of our warriors pose many challenges and nursing must rise to their meet their evolving needs and do . . . in time. This project has significant value for both the military and civilian sectors. For military nurses, the need is great. Much research and funding has gone into developing programs and Centers of Excellence for our corpsmen and medical colleagues. However, few programs exist for the deploying nurse. This program seeks to partially close the gap on a piece of the trauma care training process. The intent of this software is to accelerate time to knowledge and skill acquisition and enable a more targeted use of SME's time directed towards hands-on mentorship instead of delivery of didactic material. This product may also complement didactic course time that will be easily available for use and practice. It could also be helpful for those individuals that may have difficulty with traditional didactic learning methods, by providing an alternative training method. Since one of the primary roles of a military nurse is the training of our corpsmen and the mentorship of our juniors, this program can be a significant adjunctive support in these endeavors.

The skills and knowledge incorporated into this program from "lessons learned" also have major significance for civilian nurses. This program gives the civilian nurse the benefit of being able to share the knowledge and techniques gleaned from the military nurses' extensive experience with mass casualty and catastrophic trauma. Our civilian colleagues would be able to experiment with the strategies and techniques honed in the war zone but applicable here in this country. Additionally, the curriculum embedded into

this interactive virtual environment provides a process to expedite training from novice or advanced beginner to a more competent and confident professional.

The Research Phase of this project during year 2 will compare the immersive computer trauma training program with the standard Navy pre-deployment training offering (no supplemental training or the 2 day pre-deployment course offered at Naval Medical Centers Portsmouth and San Diego). A separate IRB proposal will be used for this Human Research Phase of the Avatar Pre-deployment Nurse Training Program.

6. PUBLICATIONS, ABSTRACTS, AND PRESENTATIONS:

On March 12, 2013, a poster presentation titled "An Interactive, Avatar-Rich Virtual Environment for Pre-Deployment Nursing Knowledge and Teamwork Skills Training" was made by T. Robert Turner during the 2013 International Symposium on Human Factors and Ergonomics in Health Care (Baltimore, MD).

7. INVENTIONS, PATENTS AND LICENSES:

N/A

8. REPORTABLE OUTCOMES:

Avatar Pre-deployment Nurse Training Software is in development.

- Module 1, Prelude, This module includes the General Introduction to the training program and process as well as test items for the knowledge pre-exam. *Status: Complete*
- Module 2, Navigation Tutorial: The Tutorial includes an introductory scenario to familiarize the learner with the computer system's navigation controls, interactive elements, and communication options. *Status: Minor updates required to address new navigation capabilities required as the trauma scenarios develop.*
- Module 3, TeamSTEPPS (AHRQ): This module educates learners about teamwork and communication principles for patient safety. We are providing interactive game-based learning experiences in this content. *Status: Complete.*
- Module 4, Introduction to Trauma: Involves the care of a virtual patient presenting with a high lower extremity amputation and large abdominal wound with evisceration of abdominal intestines from an improvised explosive device. Care of the patient will also address primary and secondary assessment, hemorrhage control, intubation, medications, and hyperthermia. *Status: In progress.*
- Module 5, Putting it all Together *Status: In development.*

9. OTHER ACHIEVEMENTS:

Nothing to report.

10. REFERENCES:

Owens, Brett D., et al. "Combat wounds in operation Iraqi Freedom and operation Enduring Freedom." *The Journal of Trauma and Acute Care Surgery* 64.2 (2008): 295-299.

11. APPENDICES:

Appendix A: Quad Chart
Appendix B: Screen Shots of Virtual Environment

Appendix A: Quad Chart

A Theoretically Driven Investigation of the Efficacy of an Immersive Interactive Avatar Rich Virtual Environment in Pre-deployment Nursing Knowledge and Teamwork Skills Training

Award Number: W81XWH-12-2-0026 Proposal Number: 11224005

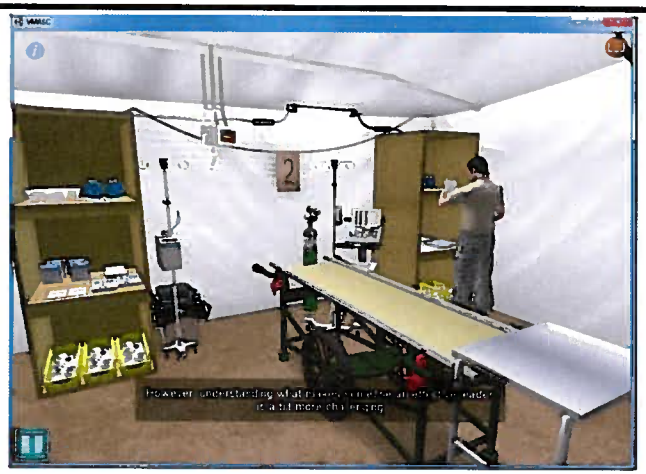
PI: V. Andrea Parodi, RN, DSN **Org:** Telemedicine and Advanced Technology Research Center **Award Amount:** $1,999,894

DMRDP

Study Aims Phase I of II

- Develop an instructionally sound, evidence based pre-deployment curriculum for military nurses that uses multiple levels of simulation using scenarios that incorporate the most prevalent war time wound/injury patterns (from JTTR data), their corresponding CPGs, and the skillsets needed for competent teamwork and nursing care.
- Design an avatar rich, virtual trauma training environment built on a game based engine that incorporates this curriculum and captures performance measures.
- Research Phase II: Test the efficacy of the simulation based computer generated training based on the performance outcomes of Military nurses, both from computer generated assessments of virtual clinical performance on test scenarios as well as actual performance outcomes from simulation center scenario execution.

Approach: In order to capture the needs of the deploying military nurse, Army/Navy Nurse Corps input is necessary for generation of scenarios/curriculum that form the basis of a "manufactured experience", fostering critical thinking and clinical competence. Military nurses will be recruited for efficacy testing in Phase II.



Accomplishment: Above please find the environment of the virtual ER that has been created by VMASC/BreakAway. This emerging environment has been updated to include nurse avatars, equipment and supplies.

Timeline and Cost

Activities CY	12	13	14
IRB Approval of Software Development Phase	X	X	
Generation of Scenarios	X	X	
Module Development	X	X	
Purchase of eye tracker	X		
Purchase of lap tops (5)	X		
IRB Approval of Research Phase		X	
Travel to testing sites	x	X	X
Final Analysis and Report			X
Estimated Budget	$704,765	$971,346	$323,783

Budget Expenditure to date for CY2012 and 2013

Projected Expenditure: $1,676,111 Actual Expenditure: $1,011,224.10

Updated: 23May2013

Goals/Milestones

CY13 Goals – Module Development Phase

☐IRB Approval obtained from Navy and Army for the development of the simulation based computer generated nurse training modules (Process Improvement Phase I). Teaming with Ryder TTC, DMRTI, ISR, Borden Institute, and Trauma team at BAMC.

☐Scenarios reflect JTTR data & lessons learned for the most prevalent poly-trauma presentations seen on deployments and the corresponding care.

☐ VMASC/BreakAway ltd to complete 5 modules.

CY13 Goal – Research Phase

☐Obtain IRB Approval for the Research Phase II.

☐Continue participation of Military nurses gaining SME pearls of wisdom and lessons learned.

CY14 Goal – Study Completion

☐Wrap up the Research Phase, efficacy testing using training software and multiple types of simulation.

☐ Data Analysis and Final report.

Appendix B: Screen Shots of Virtual Environment

Figure 1: Resources Page includes manuals and/or videos of trauma care equipment commonly used in the field.

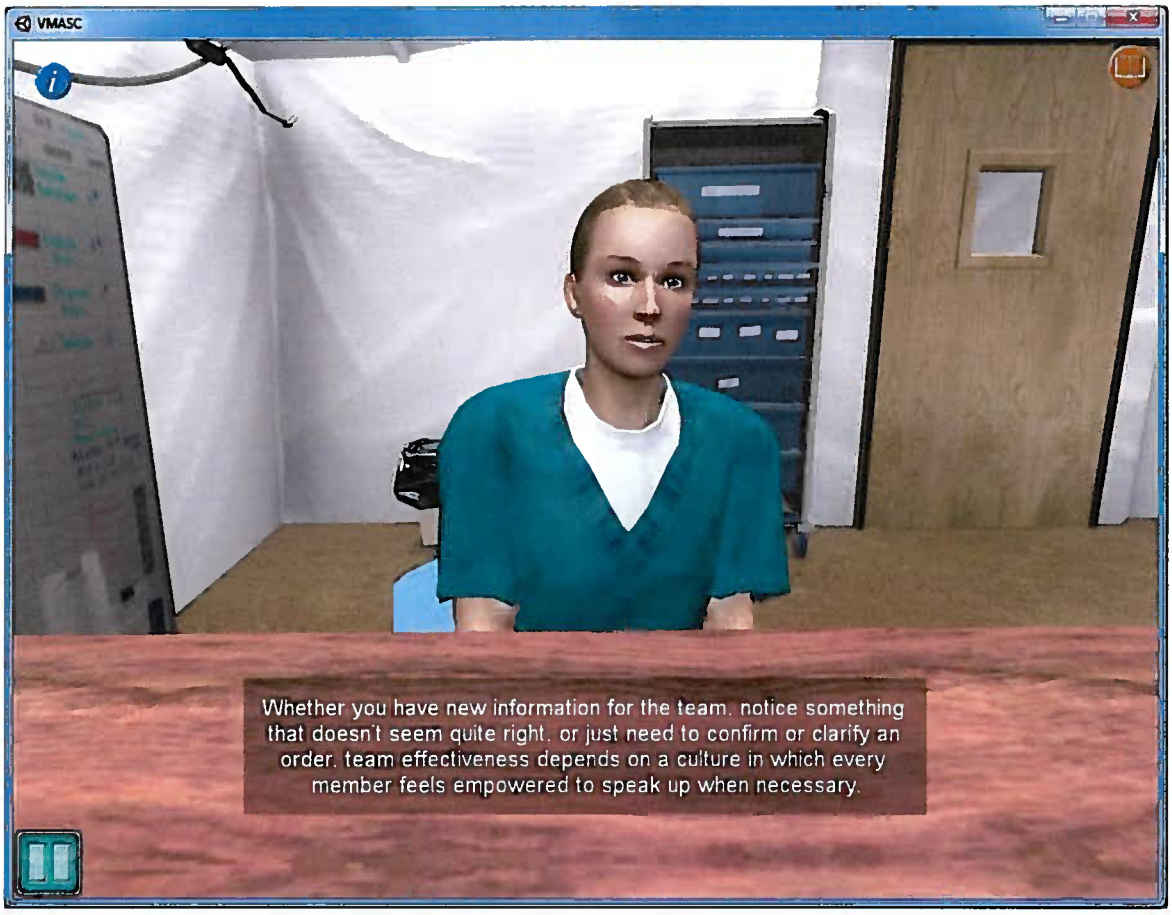


Figure 2: This is a screenshot of the conference room where mentoring of the learner takes place, as well as debriefing.

Figure 3: This is another screenshot of the conference room.

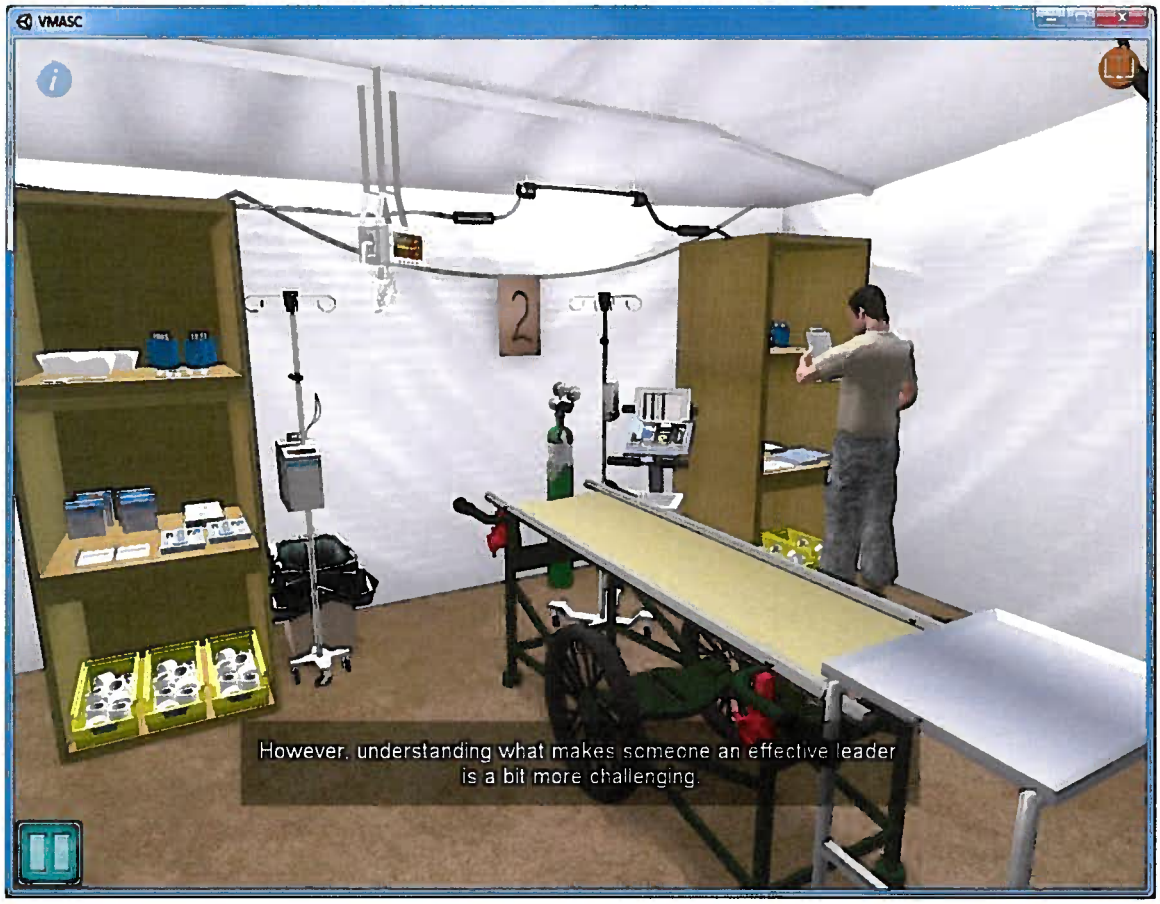


Figure 4. This screenshot illustrates the look of the Trauma/Casualty Receiving area.

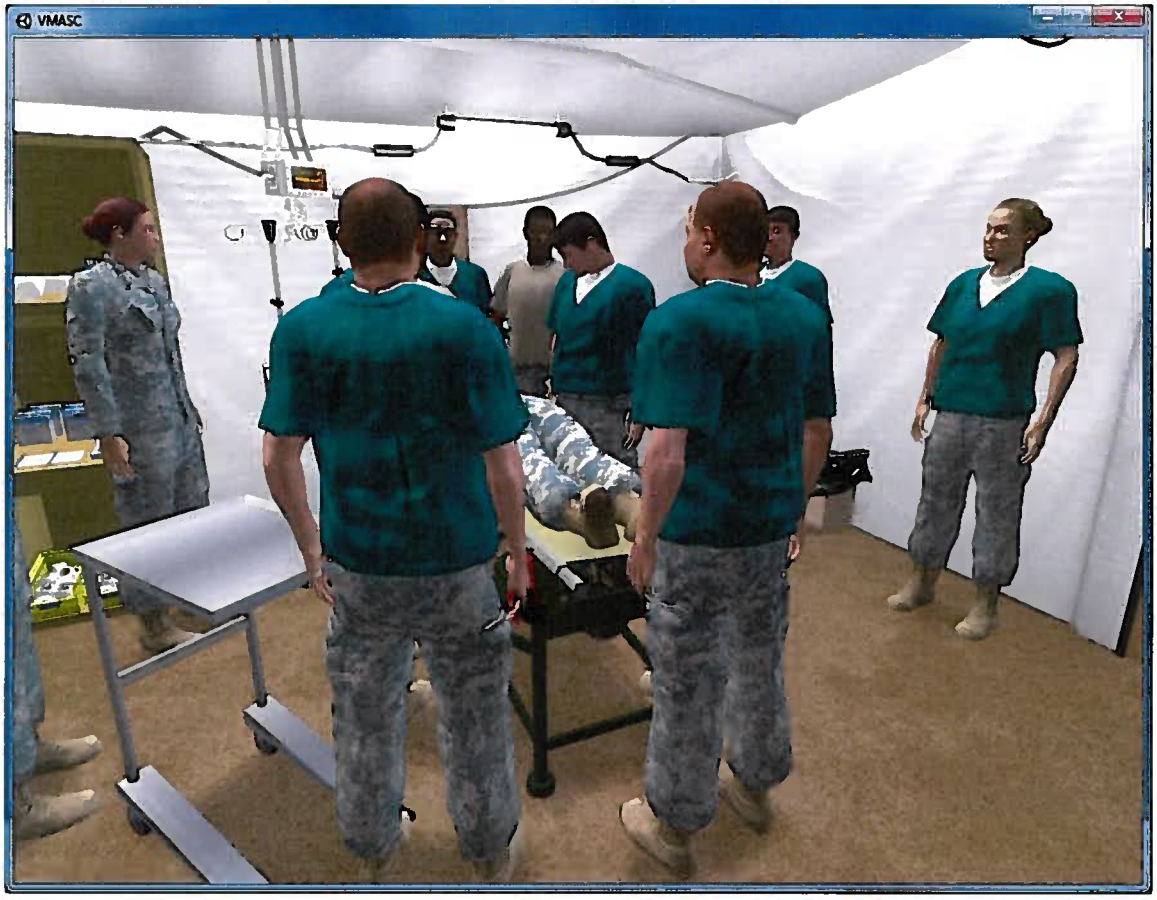


Figure 5. This screenshot illustrates the look of the avatars as they assemble around the patient according to their assignment and role.

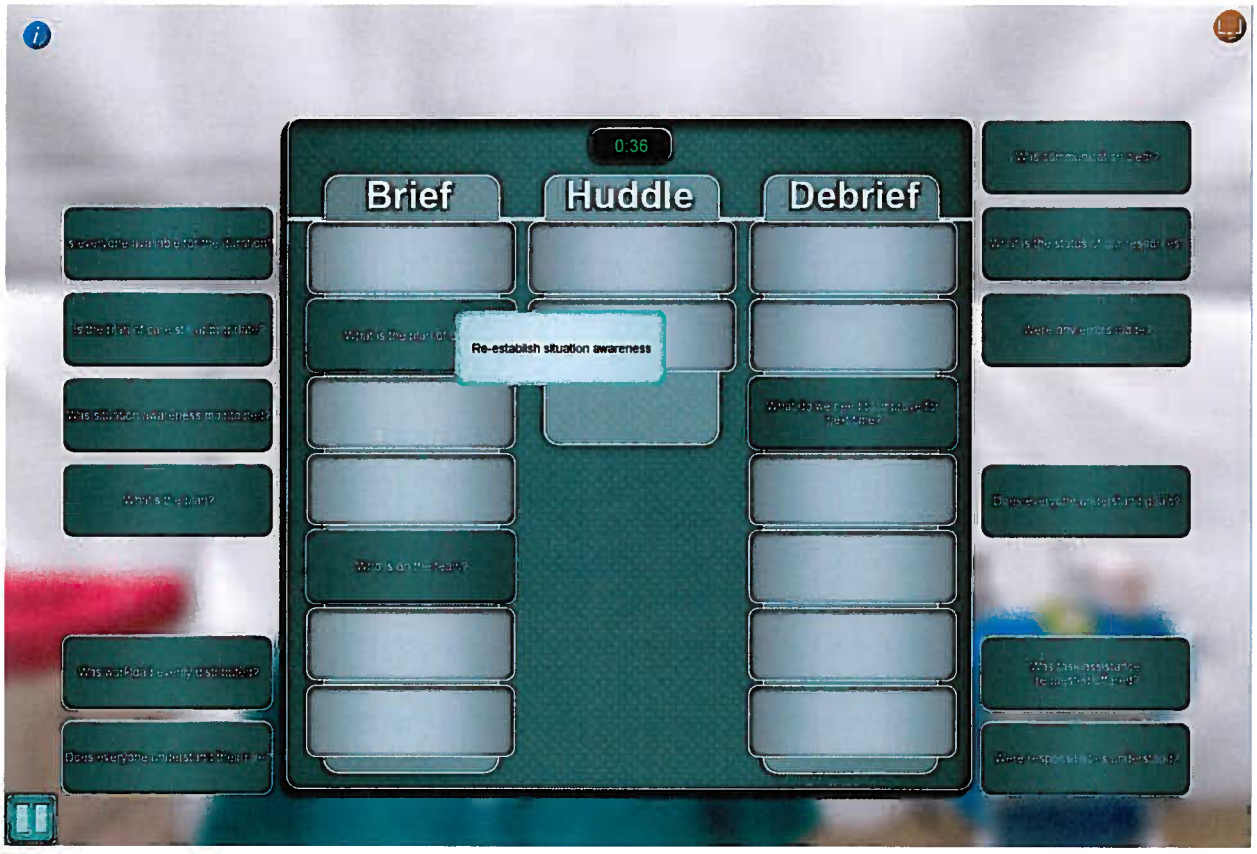


Figure 6. This screenshot illustrates one of the TeamSTEPPS mini-games.